



Smithsonian

SCIENCE
for Global Goals

ENERGY!



Part 5:

**Using
Energy to
Get Around**

SUSTAINABLE DEVELOPMENT GOALS

developed by



Smithsonian
Science Education Center

in collaboration with

iap **SCIENCE**
HEALTH
POLICY
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PART 5: USING ENERGY TO GET AROUND

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Find out More!

For additional resources and activities, please visit the *Energy!* StoryMap at <http://bit.ly/3Kx41Jy>.



Planner

Activity	Description	<u>Materials and Technology</u>	<u>Additional Materials</u>	<u>Approximate Timing</u>	<u>Page Number</u>
Task 1: How is energy used for transportation in our community?					
<i>Discover</i>	Ask yourself and others in your household about your transportation use.	<ul style="list-style-type: none"> • Paper • Pens or pencils 		10 minutes for reflection + interview time	141
<i>Understand</i>	As a team, select from three investigations that will help you learn about transportation in your community.	<ul style="list-style-type: none"> • Paper • Pens or pencils • Internet (optional) • Paper or online map (optional) 	<u>Energy Source Cards</u>	10 minutes + community investigation time	142
<i>Act</i>	Use your <u>How We Use Transportation</u> document and the results of your investigations to create a list of what you want to keep the same and what you want to change about transportation in your community.	<ul style="list-style-type: none"> • Paper • Pens or pencils 	<u>How We Use Transportation</u>	40 minutes	151



Activity	Description	Materials and Technology	Additional Materials	Approximate Timing	Page Number
Task 2: How can we make transportation more sustainable?					
Discover	Explore the Avoid, Shift, and Improve strategy and think about how it could be used in your own community.	<ul style="list-style-type: none"> • Paper • Pens or pencils 	<u>Futures Mood Board</u>	25 minutes	154
Understand	As a team, select from three investigations that will help you learn about transportation in your community.	<ul style="list-style-type: none"> • Paper • Pens or pencils • Paper or online map (optional) 		5 minutes + investigation time	156
Act	Use the information from Task 1, Act, and Task 2, Discover and Understand, to redesign the transportation in your community.	<ul style="list-style-type: none"> • Paper • Pens or pencils • Video or audio recording equipment (optional) • Camera (optional) 	<u>Futures Mood Board</u>	60 minutes	159



Meet Your Research Mentor

Meet Felipe Ramírez Buitrago. Felipe (pronounced *Fel-EE-pay*) will be your research mentor to help you understand how **sustainable energy** can be used for transportation and how communities make decisions.

Felipe is the director of urban mobility at the World Resources Institute’s Ross Center for Sustainable Cities. Felipe has a bachelor’s degree in civil and industrial engineering. He also has a master’s degree in urban planning and a master’s degree in construction engineering and management. He has special expertise on how to use sustainable energy to create **equitable** and **inclusive** transportation in cities. Felipe used his knowledge to help the city of Bogotá in Colombia switch to electric buses for public transportation. Bogotá now has the second-largest **fleet** of electric buses in the world.

However, he also has knowledge and **perspectives** that come from other parts of his **identity**. Since Felipe is now working with you, it is important to understand who he is.

Felipe’s Identity Map

Male

38 years old

Latin American

Has a beard, black eyes, and is tall

Lives in Washington, D.C.

Bogotá, Colombia, is special to him

Likes to walk, read, and travel

Listens to all types of music

For fun he uses a bike

Eats all kinds of food

Interested in quality of life

Is not shy

Values positivity over **pessimism**

Likes to help others, including animals

Interested in **urban planning** and transport planning

Has a tattoo of a bike on his ankle

Wants to achieve sustainable, equitable, and inclusive cities for all

Was the CEO of TransMilenio, a bus-based **rapid transit** system



Task 1: How is energy used for transportation in our community?

Transportation is about moving people and things from place to place. Sometimes people or things are moved using energy from people, such as walking, using a bicycle, or pushing a wheelchair. Sometimes we use other sources of energy, such as gasoline or petrol, electricity, biofuel, solar power, or wind. Cars, buses, trains, airplanes, and ships are all examples of transportation that use these types of energy sources.

Right now, most kinds of transportation around the world use non-sustainable sources of energy. But communities can make choices about the sources of energy they use for transportation. These choices can help make transportation more sustainable, safer, cheaper, and more **accessible**.

In this task you will **discover** how you and people in your household use transportation and what **concerns** or worries you. You will collect **data** to **understand** more about the sources of energy used for transportation in your **community**, how transportation is used by people in your community, and **equity** and transportation. Finally you will **act** to create a list of the most important perspectives to remember when thinking about a sustainable future for energy in your community.

Before you begin the rest of Part 5, think quietly to yourself about Felipe's identity map.

- Are there things you have in common with Felipe?
- Are there ways in which you are different from Felipe?
- Can you see anything about Felipe's identity that makes it easier for him to find sustainable energy solutions for transportation?

During Part 5 you will notice Felipe sharing ideas and experiences with you. He may help you understand better ways to conduct investigations, or he may share some of the work he has done.





Discover: How do people in my community move from place to place?

There are many ways to move from place to place. Some people walk, use a wheelchair, ride a bike, use a private car, or take the subway. In this activity, you will explore how you and the people in your household use energy through transportation to meet your needs. This information will help you figure out what you want to change about energy use and transportation in your community.

1. Get a blank document. Title it, "How We Use Transportation." You will use this document to record all the ways you and the people in your household use transportation in a day, a week, or another period of time that your team chooses.
2. Divide the paper into three rows. Label the rows "Types of Transportation," "Effect on Me," and "Energy Sources."
3. Answer these questions and record your answers in your document:
 - a. Under *Types of Transportation* answer: What kind of transportation do I use to get from place to place? Why?
 - For example, "I went to school today using a public bus. I went home on a public bus. We don't have a school bus so I use the public bus. My friend's parent used their car in the evening to take me and my friend to sports practice. I walked home from the sports field because it would save my family money and because the bus stop is not close to the field."
 - b. Under *Effect on Me* answer: How do my transportation choices affect me? Consider the four perspectives: **social**, **environmental**, **economic**, and **ethical**.
 - For example, "I sit and talk to my friend when we are riding the bus to school together. It is a good part of my day (social perspective). When I am walking home from my sports practice there is a lot of exhaust from cars around me (environmental perspective). It costs a lot of money to own a car, so my family does not have one (economic perspective). It sometimes feels unfair that moving around takes much less time for people who have cars (ethical perspective)."



- c. Under *Energy Sources* answer: What kind of energy sources does your transportation use? If you don't know, you can ask whoever is driving the vehicle or use your *Energy Source Cards* to help.
- For example, "The bus runs on gasoline. My friend's parents' car is electric."
4. Interview one or two people in your household using the same questions. Record their answers on your *How We Use Transportation* document.

Emotional Safety Tip

Difficulties with transportation can create problems with a person's health, education, and relationships with others. This may be true for you or people in your household. This might make you feel angry, sad, or upset. These feelings are normal. It is important to think about difficult situations in your community because that means you can consider ways to help make them better. However, it is okay to ask to pause if you are uncomfortable or upset.

5. Keep your *How We Use Transportation* document. You will need it in the rest of this part.



Understand: *How does transportation affect my community?*

You and your team are trying to help your community use sustainable energy for transportation. First, you need to know more information about how your community gets from place to place, what energy sources are used, and how people are affected by transportation.

In this activity, you and your team will plan and carry out investigations about transportation in your community. The data from these investigations will help you decide what is most important to change about transportation in your community.

1. Read *How People and Things Move from Place to Place* on your own.



How People and Things Move from Place to Place

There are many kinds of transportation around the world. Some kinds of transportation, such as rolling, walking, and riding a bicycle, use energy from people to move. Other kinds of transportation use manufactured sources of energy such as the ones listed on your *Energy Source Cards*. The kinds of transportation are listed here.

Light-duty vehicles typically move small numbers of people or amounts of things. Examples are cars, motorcycles, electric bicycles, electric scooters, auto-rickshaws, motorized tricycles, minivans, and smaller pickup trucks.

Heavy-duty vehicles typically move large numbers of people or amounts of things. Examples are large vans, large pickup trucks, tractor-trailers, garbage trucks, cement trucks, or buses.



Figure 5.1: This bus is able to move many people at once, but it uses a non-sustainable form of energy.

Rail is a form of transportation that can move people or things along a railroad track. Examples are trains or subways.

Ships move people or things on bodies of water. Examples are cargo ships, container ships, ferries, cruise ships, or barges.

Aircraft move people or things through the air. Examples are airplanes or helicopters.

Off-road vehicles move people or things in areas without roads. Examples are tractors, bulldozers, all-terrain-vehicles, mining equipment, or ride-on lawn mowers.

Pipelines move liquids over a distance using a large pipe and pumps.



2. Gather as a team.
3. Read *Investigations 1, 2, and 3*. These investigations can help you figure out more about transportation and energy use in your community. Decide which investigation each team member would like to do. You can work by yourself or with others. You can do one of the investigations, some of them, or all of them.

Investigation 1: Energy for Transportation in Our Community

Most forms of transportation still use non-sustainable sources of energy. This means changing to sustainable sources of energy for transportation could help lower your community's **greenhouse gas emissions**.

This investigation will help you figure out the kinds of transportation in your community, the sources of energy they use, the ways they help people, and the things that worry or concern you. You can use this investigation to help you make decisions about switching to more sustainable sources of energy.

- a. Get out a piece of paper or choose another way to record information.
- b. Make a table like the one in Figure 5.2. The first line has been filled in as an example, but you should fill in the answers from your own perspective.
- c. Work with your team to gather the information to fill in the table. You can:
 - Observe the transportation in your community directly. For example, you could observe one road in your community over a period of time, or move around the parts of your community and record any kind of transportation you notice, such as buses, tractors, cars, ferries, or pipelines.



Physical Safety Tip

If you are near a road, be careful of vehicles like cars and bicycles. Make sure you pick a spot to make your observations where you can be safe.

- Communicate with others in your community about the kinds of transportation they have observed, the sources of energy used, and what benefits or worries them. Ask them why they use a certain kind of



transportation. Is it because it saves time, money, or makes them feel like they belong? Do they use a certain kind of transportation because of what it makes people think of them? You could do a **survey** or an interview.

- Use the Internet to research the sources of energy for each kind of transportation you observe, or use your *Energy Source Cards*. Or you could communicate with community members such as bus drivers, truck drivers, railway companies or railway engineers, public subway operators, taxi drivers, ferry operators, farmers, construction workers, people who have a personal vehicle, or pipeline operators or engineers.
- Examine a paper or online map of the public transportation in your community to explore what kinds of buses, trains, ferries, trolleys, or subways are available.
- Ask your local government for a list of kinds of transportation in your community. For example, a department of motor vehicles may be able to tell you the kinds of transportation that are registered in your community.
- Remember that you made observations about energy in the Community Observation Activity in Part 1, Task 2, Discover. You can also use those observations to help you fill in the table.

Kind of transportation	What have we observed in our community?	What source of energy does this transportation use?	How does this transportation help my community?	What worries or concerns me?
Light-duty vehicles	Car, motorcycle	Gasoline from petroleum, some electric vehicles	Helps people get exactly where they want to go	Loud, makes air pollution, causes traffic
Heavy-duty vehicles				
Rail				
Ships				
Aircraft				
Off-road vehicles				
Pipelines				

Figure 5.2: A table for recording the kinds of transportation in a community, with the first row filled in as an example.



Investigation 2: Energy to Transport People in Our Community

Light-duty vehicles are some of the biggest contributors to greenhouse gases because they mostly use non-sustainable fuels like gasoline and diesel. And many light-duty vehicles are only used by one or two people at a time, even if they have enough seats for several people. This means that not only do light-duty vehicles contribute to **climate change**, but they are not moving as many people as they could.

In this investigation, you will observe both the light-duty and heavy-duty vehicles using a road in your community and record how many people are being moved by each vehicle.

- a. Work by yourself, with a partner, or as a team.
- b. Find a safe, comfortable, accessible place where team members can stay in one place and observe vehicles that are using one section of road. Choose a place and time that allows you to observe plenty of vehicle traffic. Make sure you are not too close to the road or distracting drivers as you do your investigation. You could also do this investigation by recording vehicle traffic with a video camera that you leave in one place. You could also use an online traffic camera recording of a local road or highway, if one is available in your community.
- c. Decide how long you would like to observe. It can be just a few minutes or longer.
- d. Get out a piece of paper or choose another way to record information.
- e. Make a table like the one in Figure 5.3.
- f. As light- and heavy-duty vehicles pass by, observe how many people are in each vehicle. If you observe one person in the vehicle, make a mark in the *Vehicle with one person* column. If you observe more than one person in the vehicle, make a mark in the *Vehicle with more than one person* column.
 - This observation uses sight. If you have team members who are blind or low-vision, talk to them about any tools they typically use to take part in investigations that involve sight. Make sure those tools are available. Or



discuss how these team members could help with recording or analyzing data instead of collecting it. Consider describing the vehicles as they pass so all team members feel included in the process.

Vehicle with one person	Vehicle with more than one person
XXXXXXXXXXXXXXXXXXXXXXXXX XXXXXXXXXX	XXXXXX

Figure 5.3: Sample table with the results of an observation of light- and heavy-duty vehicles.

Investigation 3: Transportation, Energy, and Barriers

Often people want to make sustainable transportation choices that use less energy. But not everyone has the same **access** to transportation and transportation choices. Figure 5.4 has more information about global access to public transportation, which is often a more sustainable form of transportation.

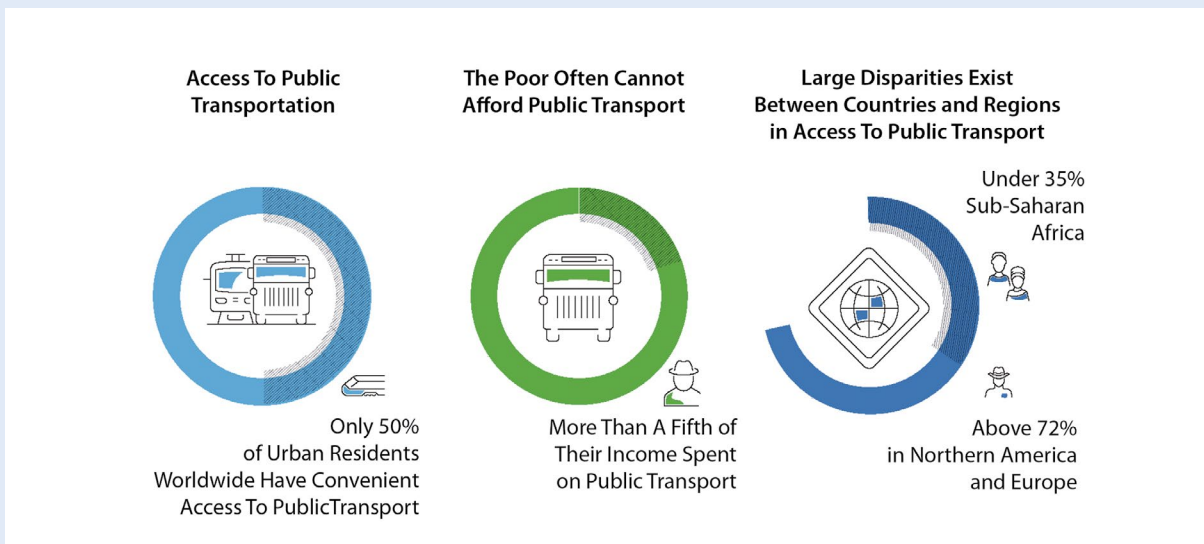


Figure 5.4: This graph from the United Nations shows access to public transportation in urban areas.

In this investigation, you will find out more about transportation and equity in your community. You will investigate barriers that make it harder for people to choose sustainable kinds of transportation.

This will help you figure out which parts of your community are most important to change. Then, you and your team can design solutions that use sustainable energy to make these changes happen.



- a. Work by yourself, with a partner, or as a team.
- b. Pick one or more sustainable transportation choice(s) you would like your community to make.
 - Sustainable public transportation: Use more public transportation, such as public buses, subways, or trains
 - Sustainable individual transportation: Use more sustainable individual transportation, such as a bicycle or an electric car
- c. Think about the barriers or reasons people are unable to do something. Use your social, environmental, economic, and ethical perspectives to help you think. For example:
 - Sustainable public transportation: Are there cultural reasons people do not use public transportation? Is it possible for someone with a disability to access public transportation? Is it expensive to use? Do some people feel uncomfortable or unsafe using it?
 - Sustainable individual transportation: Are there health reasons people do not feel comfortable walking or bicycling? Is the air pollution a problem? Is it too expensive to buy an electric car? Are only some people in your community able to safely use a bicycle due to where they live?
- d. Decide which barrier you would like to investigate further.

Gather Information

You can gather information about your community in many different ways. For example:

Mapping access: Use a map of your community that shows the location of areas or neighborhoods, buildings, roads, and public transportation. You may need more than one kind of map to gather all this information. You can use paper maps, maps you make yourself, or online maps. You can also directly observe your community.

- If you are researching sustainable public transportation, you could circle places such as bus stops or train stations that offer access to public transportation. Then notice whether there are some communities that are far away from places where they could get on public transportation.



- If you are researching sustainable individual transportation, you could search for things like bike lanes that make it easier and safer to ride a bicycle, or sidewalks that make it easier and safer to walk. Are there more bike lanes or sidewalks in some parts of your community?

If you need more ideas, you can also use the *Sustainable Communities!* community research guide. Part 5, Task 2, Discover, has information about making maps of transportation in a community.

Affordability: What are the economic reasons people feel they cannot make choices to save energy in transportation? You can find out this information in different ways:

- a. Examine prices: Use online resources or printed materials to collect the prices of transportation. For example:
 - If you are researching sustainable public transportation, maybe you want to examine ticket prices and how that relates to different people's daily income.
 - If you are researching sustainable individual transportation and you would like to encourage people to switch to electric cars, maybe you can research the price of electric cars or the cost of electricity to charge a car versus a tank of gasoline. Can most people in your community afford to switch?
- b. Interview: You could talk to people who are using public transportation or making decisions about individual transportation and ask them about their economic concerns.

 **Emotional Safety Tip**

It can be hard to communicate with other people in the community. You may feel shy or nervous. Someone may tell you they don't want to talk. That's okay! It doesn't have anything to do with you. It just means they don't want to share. You can show them respect by thanking them and moving on to another community member.





Figure 5.5: This photograph shows several ways that people move from place to place. Do you notice anything that makes this road safe for people who are walking?

You can also choose other ways to investigate a barrier. For example, you could talk to someone who has trouble moving around and discuss how that might be a barrier to making sustainable transportation choices. Or you could ask people about whether they feel safe on public transportation.

At the end of your investigation, think carefully:

- Are some groups more affected by barriers than others?
- How does that make you feel?
- What are the consequences of those barriers for encouraging people to switch to more sustainable transportation choices?

4. Carry out the investigation or investigations you decided to do.
5. When you have finished your investigations, stop and consider whether you would like to add any information to your *Energy Source Cards*. For example, you may have noticed some positive and negative effects of certain sources of energy.
6. Find a safe place to keep any data you recorded during your investigations. You will share it with your classmates in the next activity.
7. Read Felipe's thoughts about why it is so important to switch to sustainable sources of energy for transportation. Did you notice any of the effects he talks about in your investigations?



Felipe Says . . .

One of the reasons we have to work really hard on using sustainable energy for transportation is our health. Using high-carbon energy sources can produce **particulate matter**. Particulate matter can negatively affect the health of our lungs.

The second reason we have to work really hard on using sustainable energy for transportation is climate change. Electrifying transportation will help us fight against climate change. We need to adapt and be resilient to the consequences of climate change that are already happening in the world.

**Act:** *What do I want to change about transportation in my community?*

In the Discover activity you described how you and people in your household use transportation in your community. You also thought about what worries you. In the Understand activity you carried out investigations to find out more about how your community uses transportation, what sources of energy are used, and what's unfair about transportation. In this activity, you'll use all this data to figure out what you want to change about transportation in your community.

1. Get out your *How We Use Transportation* document from the Discover activity.
2. Get out the data from your investigations in the Understand activity.
3. Use the data and information from your *Energy Source Cards* to answer these questions on your own:
 - a. What do I want to keep the same about transportation in my life? What do I want to keep the same about transportation in my community?
 - For example: "I use the city bus to get to school and to see my friends. Even though the buses use gasoline, I still want to be able to use the bus. It's the only way I can get around."



- b. What am I most concerned about and want to change?
 - For example: “My neighborhood is near a big highway. It’s loud and the air seems dirty. My family can’t afford a car, but there are very few sidewalks, so walking isn’t easy either. My sister uses a walker and it’s really hard for her to get from place to place safely. I wish there were more buses and trains in our neighborhood.”
4. Record your answers. You will share them with your team.
5. Gather as a team.
6. Share your answers from step 3.
7. Make a list of what you want to keep the same and what you want to change about transportation in your community.
8. Examine your list. What perspectives do you notice? Remember that you learned about social, economic, environmental, and ethical perspectives in Part 2. You can use your *Perspectives Chart* or your *Sustainable Energy Statement* to help you. Some examples are listed here:
 - a. Social: I want transportation to be able to help me visit my friends.
 - b. Economic: I need public transportation because I can afford it.
 - c. Environmental: I’m worried about the air pollution near the highway.
 - d. Ethical: It’s not fair that my sister can’t get around with her walker.
9. Read Felipe’s perspective on switching to sustainable transportation. He discusses why it is important to use electric vehicles and make sure that electricity comes from sustainable energy sources. Do you want to include his perspective in your list of concerns?



Felipe Says . . .



In Bogotá around 70% of energy comes from **hydroelectric** power. So when I was helping Bogotá switch to electric buses, I didn't have to think about how to also switch to low-carbon sources of electricity.

But in my new job I think about problems all around the globe. Not every community has low-carbon sources of electricity. Some people come to me and say, "Hey, if we try to build an all-electric transportation fleet in a place where the source of electricity is 70% coal, we will harm the environment, so we should not try to electrify a fleet of vehicles." My perspective is that we have to do both. If we don't try to build an electric fleet *and* use low-carbon sources of electricity, we are going to face a really huge problem.

10. Which perspectives feel the most important to include?
11. Examine your list again. Is there anything you want to remove from the list, based on which perspectives you think are most important?
12. Keep this list of what you want to keep the same and what you want to change about transportation in your community in a safe place. You will need it in the Task 2, Act activity.



Task 2: How can we make transportation more sustainable?

In this task you will **discover** your **hopes** for sustainable transportation in your community. Then you will use investigations to **understand** how you could use the Avoid, Shift, and Improve **strategy** in your community. Finally, you will **act** by designing an updated transportation system in your community that reflects what you learned.



Discover: *What do I want transportation to be like in the future?*

Remember that in Part 1, Task 1, Discover you made a Futures Mood Board with your hopes and concerns for the future. You are going to use that same creative thinking in this activity and consider your hopes for transportation in your community.

1. Read Avoid, Shift, and Improve.

Avoid, Shift, and Improve

The **United Nations** uses a strategy called Avoid, Shift, and Improve to imagine a more sustainable future for transportation.

Avoid: This means reducing the *amount* of transportation people use. This could mean adding safe and accessible sidewalks to the roads or placing grocery stores close to people's homes. Or it could mean making some jobs **telecommute** jobs that don't require travel to an office.

Shift: This means making changes to the *kinds* of transportation people use. For example, choosing transportation that uses energy from people, such as rolling, walking, or bicycling, or transportation that uses sustainable sources of energy, such as electric vehicles or ships that use biofuels. Or it could mean using public transportation or ride-sharing.

Improve: This means making changes to *how* we provide transportation to communities. For example, making transportation more accessible to people in **rural** areas or to people with disabilities. Or it could mean improving the battery life of electric vehicles.



2. Examine your list of what you want to keep the same and what you want to change about transportation in your community from the Task 1, Act activity. If money, time, and the laws or rules of your community didn't matter, how would you use Avoid, Shift, and Improve to make transportation more sustainable in your community? Use your imagination and think big. Don't worry about making a perfect plan. Think quietly to yourself about the following questions and record your answers:
 - a. How would you help your community *avoid* transportation that uses energy sources that are not sustainable?
 - b. How would you help your community *shift* to using transportation that uses more sustainable energy sources?
 - c. How would you help *improve* transportation in your community?
3. Discuss your answers with your team.
4. Read about Felipe's example of how improving transportation may also improve **gender equity**. Gender equity is fairness for all people, no matter their gender. Would you want to make a similar improvement in your community?

Felipe Says ...



Switching to electric vehicles creates an opportunity for gender equity. Women may not have been using the bus before because they were feeling harassed or unsafe. Training women to drive electric buses creates a very positive cycle in which women are able to work in a **male-dominated** industry, but also, you create the opportunity for other women to use public transportation safely.

5. Take out your *Futures Mood Board*.
6. Stop and consider if you want to add any of your answers from step 2 to your *Futures Mood Board* in the *Hopes* section. Add them now.
7. Keep your answers from step 2 in a safe place. You will use them later in this task.





Understand: How can our community make sustainable choices for transportation?

Remember that you learned about the Avoid, Shift, and Improve strategy in the Discover activity. In this activity, you will apply what you learned using investigations into transportation in your community.

1. Gather as a team.
2. Read *Avoid, Shift, and Improve Investigations*.
3. Decide which investigation each team member would like to do. You can do more than one investigation. You can work by yourself or with others.

Avoid, Shift, and Improve Investigations

Avoid

You are going to investigate whether your community could avoid using non-sustainable types of transportation.

- a. Think about the places in your community that meet your needs and how you get to those places.
 - You can use the *How We Use Transportation* document from Task 1 to help you remember.
- b. Pick one place you get to using transportation that uses energy sources that are not sustainable. For example, a place you get to using a ferry powered by diesel or a car powered by gasoline.
- c. Find a way to observe, examine a map, or make a map of the **route** you take to get to this place. For example, you could move along the route yourself and make observations directly, look at an online map of the route, or draw a map from memory.
- d. Examine this route as you think about the following questions:
 - Is there a place closer to me where I can also meet this need?
 - Could I meet this need at home using the phone or Internet?
- e. Record your answers. You will need them in the Act activity.



Shift

You are going to investigate whether your community could shift to more sustainable ways of transportation.

- Think back to Task 1, Understand, Investigation 2: Energy to Transport People in Our Community. If your team did not complete this investigation, you can move on to step d.
- Compare the number of vehicles with one passenger to the number of vehicles with more than one passenger. Which number was larger?
- If the number of vehicles with one passenger was larger, what could your community do to encourage people to ride-share? Research the following questions:
 - Does your community offer people money to ride-share? Sometimes this is called a **credit** or **subsidy**.
 - Are there lanes in the road that are just for vehicles that are ride-sharing? Sometimes these are called **high-occupancy-vehicle lanes**, or HOV. HOV lanes help people move quickly from place to place when there is a lot of traffic.
 - Are there any advertising campaigns on the radio, television, or social media encouraging people to ride-share?



Figure 5.6: This high-occupancy-vehicle lane requires at least three people in a vehicle.



- d. If your team did not complete Task 1, Understand, Investigation 2, consider whether your community could shift to using electric vehicles. Research the following questions:
- Does any place in your community sell or rent electric vehicles, such as cars, bikes, or scooters?
 - Can people in your community afford to buy or rent an electric vehicle? How does the cost of an electric vehicle compare to the average annual salary in your community?
 - Does the local government offer money if you buy or rent an electric vehicle? Sometimes this is called a credit or a subsidy.
 - Are there lanes in the road or parking spaces that are just for electric vehicles?
 - Are there any electric vehicle **charging stations** in your community?
- e. Record your answers. You will need them in the Act activity.

Improve

You are going to investigate whether your community could improve the affects transportation has on people.

- a. Think back to Task 1, Understand, Investigation 3: Transportation, Energy, and Barriers. If your team did not complete this investigation, you can skip this section.
- b. Think about the observations you made. What barriers are people in your community are experiencing?
- c. Choose one of those problems to explore in this investigation.
- d. Make observations, do research, carry out surveys or interviews, or use another method to collect more information about the problem. For example:
 - Investigate what public transportation options are available to reduce traffic, noise, and air pollution on highways and busy roads. If those roads already have public transportation, do a survey in your community to ask people what would make them more likely to use the public transportation on those roads, such as more stops, more **frequency**, or lower costs. You



could also ask if they ever worry about what their social group thinks of using public transportation and if that affects how often they use it.

- Carry out a survey in areas that have the fewest kinds of public transportation. Ask people what kind of public transportation would be the most helpful to their area and why.
- Investigate the areas that have very few or no sidewalks or bike lanes. Contact your local government, a local construction company, or a group in your community that **advocates**, or supports and encourages, sidewalks and bike lanes. Ask why the sidewalks and bike lanes are not there now. Find out how much it would cost to build them. Find out if there are any laws, policies, or rules that would prevent the sidewalks and bike lanes from being built.

e. Record your answers. You will need them in the Act activity.

4. Carry out the investigation or investigations you decided to do.

5. Keep your observations and information in a safe place. You will use them in the Act activity.



Act: *How can I help make transportation in our community more sustainable?*

In this activity, you will combine the information you imagined from the Discover activity with the information you collected in the Understand activity. You will use this information, as well as some of your ideas from Task 1, to **redesign** your community's transportation to be more sustainable.

1. Gather as a team to make a plan to redesign a part of your community's transportation system to be more sustainable. Just as you did in the Discover activity, use your imagination and do not worry about making a perfect plan. Do not worry about money or time.
2. Start by examining your team's list of what you want to keep the same and what you want to change about transportation in your community from the Task 1, Act activity.



- a. What did your team want to keep the same about transportation in your community?
 - b. What were the most important things to change?
3. Examine the information you imagined in the Discover activity and the information you collected in the Understand activity in Task 2. You will use that information to think about solutions to the problems in your community. Record your answers to the following questions:
- a. What solutions can you think of for the things you want to change about transportation in your community?
 - b. Could you avoid, shift, or improve transportation in some way?



Figure 5.7: This road is just for people using bicycles. It helps keep the people on bicycles safe from cars and encourages them to use sustainable transportation.

4. Examine your team's answers from step 3 on your own. Think about the four perspectives: social, economic, environmental, and ethical. Consider your answers from step 3 from these four perspectives. Is there anything you want to change about or add to your answers? For example:
- a. Economic and Ethical: Your team wants to redesign your community to include more lanes and charging stations for electric vehicles. But you observed that the people who earn the least money in your community cannot afford electric vehicles. They also live in areas with the least public transportation. What might be a better solution to help make transportation more affordable and more fair for people who earn the least money in your community?



5. Gather as a team again.
6. Share your answers from step 4 with your team. Add to or change your solutions and ideas from step 3, if needed.
7. Choose one or two of the solutions or ideas from step 3 to use in the rest of this activity.
8. Make a model of how you would redesign transportation in your community, based on one or two of the solutions your team thought of in step 3. For example, you could redraw a map of a busy road with high-occupancy-vehicle lanes. You can make a model in several ways:
 - a. Use paper or an online document to make a map.
 - b. Make a list of steps or a description.
 - c. Make a video or audio recording of transportation in your community.
 - d. Make a paper or digital collage of photos of transportation in your community.
 - e. Make a three-dimensional model using building blocks, discarded items, or other things that are easy for you to find.
9. Think back to the Task 1, Discover activity. You might have communicated with people who did not want your community's transportation to change. How would you communicate your plan to redesign transportation to these people? What could you say to convince them?
10. Get out your *Futures Mood Board* and add any helpful information from this task.

Congratulations!

You have finished Part 5.

Find out More!

For additional resources and activities, please visit the *Energy!* StoryMap at <http://bit.ly/3Kx41Jy>.



Glossary

This glossary can help you understand words you may not know. You can add drawings, your own definitions, or anything else that will help. Add other words to the glossary if you would like.

Access: Able to easily reach

Accessible: Able to easily reach or use a place, thing, or idea

Advocate: To recommend or support

Aircraft: A form of transportation that moves people or things through the air, such as an airplane or helicopter

Avoid: To keep from doing

Charging station: Where a person can recharge anything that stores electricity in a battery, such as a car or a mobile phone

Climate change: Changes in the patterns of temperature and precipitation on Earth

Community: A group of people who share something in common, such as a space or an identity

Concern: Something that causes anxiousness, worry, or fear

Credit: Money or the promise of money given to a person

Data: Facts and statistics that have been collected about a topic



Economic: About money, income, and the use of wealth

Emission: Material that is sent into the air, such as exhaust from a car

Energy: Anything that gives the ability to do work

Environmental: About the natural world

Equitable: Treating all people fairly

Equity: Fair treatment of all people

Ethical: Something that is fair

Fleet: A group of vehicles

Frequency: The number of times something happens

Gender equity: Fairness for all people, no matter their gender

Greenhouse gases: Gases such as carbon dioxide and methane that cause the atmosphere to get warmer

Heavy duty vehicle: Vehicles that typically move large numbers of people or amounts of things, such as large vans, large pickup trucks, tractor-trailer trucks, garbage trucks, cement trucks, or buses

High-occupancy vehicle lane: A road lane that can only be used by vehicles with more than one person inside, sometimes abbreviated as HOV



Hope: Something that is desired, wished for, or wanted

Hydroelectric: A renewable and low-carbon resource that converts energy from moving water into electricity

Identity: The characteristics that make you you

Improve: To make better

Inclusive: Making sure no one is left out

Light-duty vehicle: Vehicles that typically move small numbers of people or amounts of things, such as cars, motorcycles, auto-rickshaws, motorized tricycles, minivans, or smaller pickup trucks

Male-dominated: Something that is used or controlled mostly by men

Off-road vehicle: A vehicle that moves people or things in areas without roads, such as tractors, bulldozers, all-terrain-vehicles, mining equipment, or ride-on lawn-mowers

Particulate matter: Small airborne particles, such as pollen, dust, or smoke

Perspectives: The different ways we think about the world around us

Pessimism: Expecting things to go badly or expecting the worst outcome possible

Pipeline: A form of transportation that moves liquids over a distance using a large pipe and pumps



Rapid transit: Transportation that moves many people very quickly, especially in urban areas

Redesign: To design again with the hopes of improving the original design

Route: The way you move from place to place

Rural: A place with low housing density, like the countryside

Shift: To change

Social: Relating to the interaction of people in a community

Strategy: A plan or way of doing something

Subsidy: When the government gives someone money to encourage them to do something for the public good

Survey: A list of simple questions you can ask a group of people

Sustainable: An approach that balances different perspectives and can keep working for a long time

Telecommute: To work from a place other than an office or job site, using tools such as phones and computers

United Nations: A global organization designed to help governments and people around the world collaborate

Urban planning: Figuring out how to best use the space in a city or town

